COLORADO
Parks and Wildlife
Department of Natural Resources

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1 January 2015

Ms. Linda Bassi, Chief
Stream and Lake Protection Section
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
Denver CO 80203

SUBJ: Instream Flow Recommendations for Elkhead Creek and Armstrong Creek, Routt County, Water Division 6, for January 26-27, 2015 CWCB Meeting

Dear Linda:

The information contained in and referred to in this letter and the associated instream flow file folders form the basis for the instream flow recommendations for Elkhead Creek and Armstrong Creek to be considered by the Colorado Water Conservation Board (CWCB or Board) at their January, 2015 regular meeting. Some of the investigations related to these instream flow recommendations were initiated prior to the statutory merging of two divisions within the Colorado Department of Natural Resources; in 2011, the Division of Wildlife and the Division of Parks and Outdoor Recreation merged to form Colorado Parks and Wildlife (CPW). In 2006, the CWCB appropriated instream flow water rights on Elkhead Creek and Armstrong Creek to preserve the natural environment to a reasonable degree; the lower termini for these instream flow water rights was set to preserve the potential future development of a conditional water storage right for the California Park Reservoir. For reasons more fully described below, CPW staff is renewing our effort to secure instream flow protection for the lower reaches of these two segments. It is the CPW staff's opinion that the information contained in this letter is sufficient for the Board's staff to initiate instream flow appropriations and address the findings required in Rule 5(i) of the Instream Flow Rules.

The State of Colorado's Instream Flow (ISF) Program was created in 1973 when the Colorado General Assembly passed Senate Bill 97 which called for the recognition of "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). This statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISF Program, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CPW is recommending these segments of Elkhead Creek and Armstrong Creek to the Board for inclusion into the ISF Program. These two segments should be considered for inclusion into the ISF Program because they have natural environments that can be preserved to a reasonable degree with an instream flow water right.

The CPW is forwarding these stream flow recommendations to the Board to meet CPW's legislative declarations "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.) and "… that the natural, scenic, scientific, and outdoor recreation areas … protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and (its) visitors … and that, to carry out such program and policy, there shall be a continuous operation of acquisition, development, and management of … lands, waters, and facilities." (See §33-10-101 (1) C.R.S.). In addition to these statutory directives, the current CPW strategic planning documents (*DOW Strategic Plan*, 2010 and *A Path Forward*, 2014) state that "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations…by protecting and enhancing the quality and quantity of aquatic habitats." and that "Ensuring the long term viability of native fish and wildlife … and sport fish populations." – these statements encapsulate CPW's primary objectives and provide a guide to the agency's linkage to the goals and objectives of the CWCB ISF Program.

As stated above, the purpose of this letter is to formally transmit instream flow recommendations from CPW to CWCB for the Board's consideration for the 2015 appropriation year. The streams included in this transmittal are Elkhead Creek and Armstrong Creek, located in Routt County, Water Division 6. ISF appropriations for the upper reaches of both of these streams were secured by the CWCB in 2006, but after much deliberation, the original segments were truncated at the projected high water line for the proposed California Park Reservoir. In 2010, the water right for this reservoir was abandoned by the Division of Water Resources with the consent of the owner of that water right. In light of this development and the active management of the Elkhead basin's fishery resources (more fully described in the attached fact sheets), CPW seeks to re-initiate our request for instream flow protection for the lower reaches of these two streams. Please refer to the following fact sheets and the recommendation summary table (attached).

CPW personnel will be present at the January, 2015 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Jay W. Skinner
CPW Instream Flow Program Coordinator

Attachments

FACT SHEET

Elkhead Creek

Upper Terminus: The lower terminus of the ISF segment decreed in 06CW34

Lower Terminus: The confluence with First Creek

Natural Environment:

The entire Elkhead Creek basin has been designated (by CPW and the land management agency, USFS) as a prime location for native fish conservation. The entire basin above the North Fork of Elkhead Creek (including all tributaries) is currently being managed and enhanced through a number of interagency projects as Colorado River cutthroat habitat and boreal toad habitat. Other native species are also present (speckled dace, mountain and longnose suckers, mottled sculpin, and northern leopard frogs) and these species are water dependant and would benefit from instream flow protection. All non-native salmonids have been chemically removed from the streams and migration barriers have either been constructed or are planned. USFS and CPW biologists have sampled Elkhead Creek most recently in 2010 to monitor the ongoing project; this data has been provided to the CWCB.

R2CROSS Results:

In 2014, an R2CROSS data set was collected by CPW and CWCB staff; this data was used to supplement the data that was used in the 2006 ISF appropriation process. The following table summarizes the R2CROSS results.

Party	Date	Q	250% - 40%	Summer (3/3)	Winter (2/3)
DOW	7/26/2005	5.09 cfs	12.7 – 2.0	3.9 cfs	3.0 cfs
CPW/CWCB	7/6/2014	4.48 cfs	11.2 – 1.8	29.8 cfs	4.6 cfs

In 2006, the DOW ISF recommendations was 3.9 cfs (April – July) and 3.0 cfs (August – March); the winter flow was reduced to 1.75 cfs to reflect winter water availability. The summer flow recommendation from the 2014 data is out of range and the winter season number brings the flow recommendation up from 3 cfs to 3.8 cfs (a season that there is a known water availability issue). Due to the value of the fishery in Elkhead Creek, CPW proposes using the 250% $Q_{(meas)}$ value of 11.2 cfs to average with the 3.9 cfs result from the 2005 data to yield a flow recommendation for the summer months of 7.6 cfs. FINAL BIOLOGICAL FLOW RECOMMENDATION: 7.6 cfs (April – July) and 3.8 cfs (August – March).

Due to the value of the fishery in Elkhead Creek, CPW's recommendation to CWCB staff during the water availability analyses is to maintain the highest flows that can be shown to be available during the baseflow period and during the shoulder months on either side of the peak of the hydrograph.

FACT SHEET

Armstrong Creek

Upper Terminus: The lower terminus of the ISF segment decreed in 06CW35

Lower Terminus: The confluence with Elkhead Creek

Natural Environment:

The entire Elkhead Creek basin has been designated (by CPW and the land management agency, USFS) as a prime location for native fish conservation. The entire basin above the North Fork of Elkhead Creek (including all tributaries) is currently being managed and enhanced through a number of interagency projects as Colorado River cutthroat habitat and boreal toad habitat. Armstrong Creek is one of the tributaries where this active fishery management is occurring. Other native species are also present throughout the basin (speckled dace, mountain and longnose suckers, mottled sculpin, and northern leopard frogs) and these species are water dependant and would benefit from instream flow protection. All non-native salmonids have been chemically removed from the streams and migration barriers have either been constructed or are planned. USFS and CPW biologists have sampled Armstrong Creek in 2009 and 2014 to monitor the ongoing project; this data has been provided to the CWCB.

R2CROSS Results:

Due to the short length of this ISF segment and due to the observed uniformity of the small channel, CPW chose not to collect additional R2CROSS information on this stream and just use the existing data collected to support the 2006 appropriation for this ISF recommendation. In 2006, DOW recommended 1.0 cfs summer and 0.4 cfs winter using an R2CROSS data set collected in 2005. DOW reduced the winter season flow recommendation to 0.25 cfs based on preliminary water availability data. CWCB water availability analyses concurred with the DOW analysis and CWCB appropriated 1 cfs ((4/1 – 7/15) and 0.25 cfs (7/16 – 3/31) in case number 06CW35. At this time, CPW proposes the same numbers for the short reach of Armstrong Creek described above and on the data summary table.

Colorado Parks and Wildlife
Instream Flow and Natural Lake Level Recommendations: **Elkhead Creek and Armstrong Creek**

Water Body	Proposed Upper	LAT LONG/UTM Coordinates	Proposed Lower Terminus	LAT LONG/UTM Coordinates	Length	Counties	Water Division	Major Drainage	USGS Map(s)	Natural Environment Information	Sources and References	Biological Flow Recommendation	Additional Information and/or Supporting Data
Elkhead Creek	Lower Terminus of ISF segment decreed in 06CW34	40 deg 45' 40" N 107 deg 07' 60" W	Confluence with First Creek	40 deg 44' 01.8" N 107 deg 10' 1.51"W 4511470.132 N 317006.975 W	2.9	Routt	6	Yampa	Quaker Mountain	The entire Elkhead Creek basin above the North Fork confluence is the subject of an interagency (CPW and USFS) Colorado River Cutthroat Trout re-introduction project; when completed, this basin will be one of the largest projects of its kind. There are also known populations of boreal toad, northern leopard frogs, and mountain suckers.	USFS and CPW electofishing data for 2005, 2009, 2010, and 2014. CPW/USFS Project Plans and NFWF Narrative.	7.6 cfs (4/1-8/30); 3.8 cfs (9/1- 3/31)	The purpose of this flow recommendation is to fill in the gap that resulted from the 2006 ISF filing where the entire footprint of the California Park Reservoir site was excluded. This reservoir's water right was abandoned in 2010 paving the way for full ISF protection for the entire segment. One additional R2CROSS cross section was collected in 2014 by CPW staff; this data was used (along with the data used in the 2006 approopriation) to develop this flow recommendation.
Armstrong Creek	Lower Terminus of ISF segment decreed in 06CW35	40 deg 44' 40" N deg 08' 08" W	107 Confluence with Elkhead Creek	40 deg 44' 43.1" N 107 deg 8' 11.7" W 4512680.197 N 319614.994 E	0.3	Routt	6	Yampa	Quaker Mountain	The above statement with respect to Colorado River Cutthroat also applies to the tributary streams in the Elkhead Creek basin including Armstrong Creek.	USFS and CPW electofishing data for 2005, 2009, 2010, and 2014. CPW/USFS Project Plans and NFWF Narrative.	1.0 cfs (4/1-7/15); 0.25 cfs (7/16-3/31)	The purpose of this flow recommendation is to fill in the gap that resulted from the 2006 ISF filing where the entire footprint of the California Park Reservoir site was excluded. This reservoir's water right was abandoned in 2010 paving the way for full ISF protection for the entire segment. Due to the short length of this additional segment, no additional R2CROSS information was collected by CPW. CPW staff used the data used in the 2006 approopriation to develop this flow recommendation.

Year	Stream	Water Code	Easting	Northing	CPW Bio	Species	Station Length	Mile	Adult pop est. (reach)	CI
2005	Armstrong Creek		322018	4511669		CRN	300		1	
2009	Armstrong Creek (station 1)	19035	319727	4512523	BA	CRN	325			
2009	Armstrong Creek (station 4)	19035	321726	4511761	BA	CRN	275		9	
2009	Armstrong Creek (station 7)	19035	322535	4512206	BA	CRN	287		6	2
2014	Armstrong Creek, Lower Reference Reach	19035	321513	4511964	BA	CRN	300	5280		
2014	Armstrong Creek, Site 2 Lower	19035	319811	4512388	BA	CRN	305	5280	4	
2014	Armstrong Creek, Site 2 Upper to Site 3 Fence	19035	319861	4512340	BA	CRN	465	5280	8	
2014	Armstrong Creek, Site 4	19035	320092	4512194	BA	CRN	324	5280	0	
2014	Armstrong Creek, Upper Enclosure, DS Half	19035	321676	4511855	BA	CRN	780	5280	4	
2014	Armstrong Creek, Upper Reference Reach	19035	322181	4512068	BA	CRN	300	5280	1	
2010	Elkhead Creek (MIS)	23165	319724	4514603	BA					
2010	Elkhead Creek (stukey)	23165	318627	4512111	BA	CRN	540		4	
2010	Elkhead Creek (stukey)	23165	318627	4512111	BA	MOS	540			

1+ est. (reach)	CI	Adult pop est./mile	CI	1+ pop est/mile	CI	Capture Probability (Adult pop)	Capture Prob (1+ pop)	Other Species	
6		18		106				SPC, MTS	
3				49				(MOS, WHS, or LGS)	
19	1	173		365	10			MTS	
39	3	110	28	712	47				
16		0		282			0.25	MTS, MOS, SPD	No >150 CRN captured.
2		69		35		1.00	1.00	MTS, SPD, WHS, MOS	1 trout was observed, but not captured in Pass 2
5		91		57		0.60	1.00		
3		0		49		1.00		SPD, MTS, WHS, MOS	
32		27		217		1.00	0.53	MTS, SPD, MOS	
9		18		158		1.00	0.67		
								SPD, MTS, WHS, MOS	
8		39		78				SPD, MTS, WHS	
66				645				SPD, MTS, WHS, MOS	

2010 HTAP Project Summary

		Fish Passage Project	**Y**
State:	Colorado	**HTAP funds used:**	**$ 102,500**
National Forest:	Medicine Bow-Routt	**Other funds used:**	**$ 4,500**
Project Name:	Armstrong and Torso Culvert Replac.	**Total Project Cost:**	**$ 107,000**

Project Purpose/Objectives: This project took a watershed scale approach to evaluating fish passage in a watershed that contains Colorado River cutthroat trout, mountain sucker and boreal toad. One aquatic passage barrier was replaced in 2009, and these two in 2010.

Armstrong Creek

Work Performed:
This project replaced two culverts in 2010. The Torso Creek culvert was replaced with a 15 foot bottomless box arch and Armstrong Creek was replaced with a 15 foot bottomless arch. Stream simulation designs were used and grade control structures installed to promote low velocity habitat and fish passage. Extra wide streambanks were installed in Torso Creek to allow passage of boreal toad.

Expected Benefits:
Replacing the Torso Creek Culvert provides CRCT access to 2.1 miles of quality habitat and mountain sucker access to 1.0 miles of quality habitat. In addition, one of only three boreal toad breeding sites within the Yampa basin occurs downstream of the crossing. The project included a migration corridor for the toads. Replacing the Armstrong Creek culvert provides CRCT assess to 4.4 miles of quality habitat and mountain sucker access to 1.5 miles of quality habitat.

Torso Creek

Additional Information:
Partners: Routt County Road and Bridge, Trout Unlimited Western Water Project, & Packard Foundation, Colorado Division of Wildlife
Types of TES Species: Colorado River cutthroat trout, mountain sucker, boreal toad.
Miles of Habitat Opened/Restored: 6.5 miles

10 - 2/3 c
0.4 - 2/3 d

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Armstrong Creek
XS LOCATION:	N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER:	7260502
DATE:	26-Jul-05
OBSERVERS:	Uppendahl,Dilger
1/4 SEC:	NE
SECTION:	15
TWP:	9
RANGE:	87W
PM:	6
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	0 19035
USGS MAP:	Quaker Mnt
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

CHANNEL PROFILE DATA

SLOPE: 0.02421053

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: .....DATE.....

STREAM NAME: Armstrong Creek
XS LOCATION: N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER: 7260502

DATA POINTS= 25

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
S	0.00	5.60			0.00		0.00	0.00	0.0%
	2.00	5.90			0.00		0.00	0.00	0.0%
B	2.60	5.99			0.00		0.00	0.00	0.0%
	3.00	6.30			0.00		0.00	0.00	0.0%
	5.00	6.40			0.00		0.00	0.00	0.0%
1 G	6.80	6.65			0.00		0.00	0.00	0.0%
	7.60	6.90			0.00		0.00	0.00	0.0%
W	7.80	7.05	0.00	0.00	0.00		0.00	0.00	0.0%
	7.90	7.25	0.20	0.10	0.22	0.20	0.04	0.00	1.0%
	8.20	7.35	0.30	0.89	0.32	0.30	0.09	0.08	19.1%
	8.50	7.30	0.30	0.94	0.30	0.30	0.09	0.08	20.2%
	8.80	7.25	0.20	0.78	0.30	0.20	0.06	0.05	11.2%
	9.10	7.20	0.20	1.21	0.30	0.20	0.06	0.07	17.3%
	9.40	7.25	0.25	1.38	0.30	0.25	0.08	0.10	24.7%
	9.70	7.20	0.20	0.30	0.30	0.20	0.06	0.02	4.3%
	10.00	7.20	0.20	0.15	0.30	0.20	0.06	0.01	2.2%
	10.30	7.15	0.10	0.00	0.30	0.10	0.03	0.00	0.0%
W	10.60	7.00	0.00	0.00	0.34		0.00	0.00	0.0%
1 G	11.00	6.65			0.00		0.00	0.00	0.0%
	11.50	6.35			0.00		0.00	0.00	0.0%
	13.00	6.25			0.00		0.00	0.00	0.0%
	14.00	6.15			0.00		0.00	0.00	0.0%
B	15.00	5.95			0.00		0.00	0.00	0.0%
S	16.70	5.70			0.00		0.00	0.00	0.0%
TS	16.71	4.80			0.00		0.00	0.00	0.0%
TOTALS ----------					3.00	0.3 (Max.)	0.57	0.42	100.0%

Manning's n = 0.1025
Hydraulic Radius= 0.188328718

STREAM NAME: Armstrong Creek
XS LOCATION: N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER: 7260502

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.57	0.55	-2.0%
6.78	0.57	1.35	138.3%
6.80	0.57	1.27	125.5%
6.82	0.57	1.20	113.0%
6.84	0.57	1.13	100.9%
6.86	0.57	1.07	89.0%
6.88	0.57	1.00	77.4%
6.90	0.57	0.94	66.2%
6.92	0.57	0.88	55.2%
6.94	0.57	0.82	44.4%
6.96	0.57	0.76	33.7%
6.98	0.57	0.70	23.3%
6.99	0.57	0.67	18.1%
7.00	0.57	0.64	13.0%
7.01	0.57	0.61	7.9%
7.02	0.57	0.58	2.9%
7.03	0.57	0.55	-2.0%
7.04	0.57	0.53	-6.9%
7.05	0.57	0.50	-11.8%
7.06	0.57	0.47	-16.5%
7.07	0.57	0.44	-21.3%
7.08	0.57	0.42	-26.0%
7.10	0.57	0.37	-35.2%
7.12	0.57	0.31	-44.3%
7.14	0.57	0.26	-53.2%
7.16	0.57	0.22	-61.9%
7.18	0.57	0.17	-70.2%
7.20	0.57	0.12	-78.1%
7.22	0.57	0.09	-84.5%
7.24	0.57	0.06	-89.3%
7.26	0.57	0.04	-92.8%
7.28	0.57	0.03	-95.5%

WATERLINE AT ZERO
AREA ERROR = 7.021

STREAM NAME: Armstrong Creek
XS LOCATION: N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER: 7260502

Constant Manning's n

STAGING TABLE

GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.65	4.20	0.44	0.70	1.84	4.62	100.0%	0.40	2.24	1.22
	6.67	4.11	0.43	0.68	1.75	4.52	97.8%	0.39	2.10	1.20
	6.72	3.89	0.40	0.63	1.55	4.27	92.5%	0.36	1.78	1.15
	6.77	3.67	0.37	0.58	1.36	4.03	87.3%	0.34	1.49	1.09
	6.82	3.46	0.34	0.53	1.18	3.79	82.0%	0.31	1.23	1.04
	6.87	3.24	0.31	0.48	1.02	3.54	76.7%	0.29	1.00	0.98
	6.92	3.06	0.28	0.43	0.86	3.34	72.2%	0.26	0.78	0.91
	6.97	2.94	0.24	0.38	0.71	3.18	68.8%	0.22	0.59	0.83
WL	7.02	2.80	0.20	0.33	0.56	3.00	65.0%	0.19	0.42	0.74
	7.07	2.65	0.16	0.28	0.43	2.82	61.0%	0.15	0.28	0.64
	7.12	2.52	0.12	0.23	0.30	2.65	57.4%	0.11	0.16	0.53
	7.17	2.31	0.08	0.18	0.18	2.40	52.0%	0.07	0.07	0.40
	7.22	1.44	0.05	0.13	0.08	1.49	32.2%	0.05	0.03	0.32
	7.27	0.71	0.04	0.08	0.03	0.73	15.8%	0.04	0.01	0.26
	7.32	0.26	0.01	0.03	0.00	0.27	5.8%	0.01	0.00	0.13

$3/3_J = 1.0$

$2/3\,d = 0.40$

STREAM NAME: Armstrong Creek
XS LOCATION: N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER: 7260502

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.42 cfs
CALCULATED FLOW (Qc)=	0.42 cfs
(Qm-Qc)/Qm * 100 =	0.1 %
MEASURED WATERLINE (WLm)=	7.03 ft
CALCULATED WATERLINE (WLc)=	7.02 ft
(WLm-WLc)/WLm * 100 =	0.1 %
MAX MEASURED DEPTH (Dm)=	0.30 ft
MAX CALCULATED DEPTH (Dc)=	0.33 ft
(Dm-Dc)/Dm * 100	-9.7 %
MEAN VELOCITY=	0.74 ft/sec
MANNING'S N=	0.103
SLOPE=	0.02421053 ft/ft
.4 * Qm =	0.2 cfs
2.5 * Qm=	1.0 cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

RATIONALE FOR RECOMMENDATION:
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RECOMMENDATION BY: ..... AGENCY..... DATE:.....

CWCB REVIEW BY: ..... DATE:.....

Data Input & Proofing

STREAM NAME:	Armstrong Creek
XS LOCATION:	N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER:	7260502
DATE:	7/26/2005
OBSERVERS:	Uppendahl,Dilger
1/4 SEC:	NE
SECTION:	15
TWP:	9
RANGE:	87W
PM:	6
COUNTY:	Routt
WATERSHED:	Yampa
DIVISION:	6
DOW CODE:	
USGS MAP:	Quaker Mnt
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.024210526 ft / ft

CHECKED BY:.....DATE.....

ASSIGNED TO: .....DATE.....

Total Data Points = 25

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	S	0.00	5.60			0.00	0.00	0.00
		2.00	5.90			0.00	0.00	0.00
	B	2.60	5.99			0.00	0.00	0.00
		3.00	6.30			0.00	0.00	0.00
		5.00	6.40			0.00	0.00	0.00
1	G	6.80	6.65			0.00	0.00	0.00
		7.60	6.90			0.00	0.00	0.00
	W	7.80	7.05	0.00	0.00	0.00	0.00	0.00
		7.90	7.25	0.20	0.10	0.04	0.00	7.05
		8.20	7.35	0.30	0.89	0.09	0.08	7.05
		8.50	7.30	0.30	0.94	0.09	0.08	7.00
		8.80	7.25	0.20	0.78	0.06	0.05	7.05
		9.10	7.20	0.20	1.21	0.06	0.07	7.00
		9.40	7.25	0.25	1.38	0.08	0.10	7.00
		9.70	7.20	0.20	0.30	0.06	0.02	7.00
		10.00	7.20	0.20	0.15	0.06	0.01	7.00
		10.30	7.15	0.10	0.00	0.03	0.00	7.05
	W	10.60	7.00	0.00	0.00	0.00	0.00	0.00
1	G	11.00	6.65			0.00	0.00	0.00
		11.50	6.35			0.00	0.00	0.00
		13.00	6.25			0.00	0.00	0.00
		14.00	6.15			0.00	0.00	0.00
	B	15.00	5.95			0.00	0.00	0.00
	S	16.70	5.70			0.00	0.00	0.00
	TS	16.71	4.80			0.00	0.00	0.00

Totals	0.57	0.42

STREAM NAME: Armstrong Creek
XS LOCATION: N 40 44' 34.8" W 107 08' 05.4"
XS NUMBER: 7260502

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.42

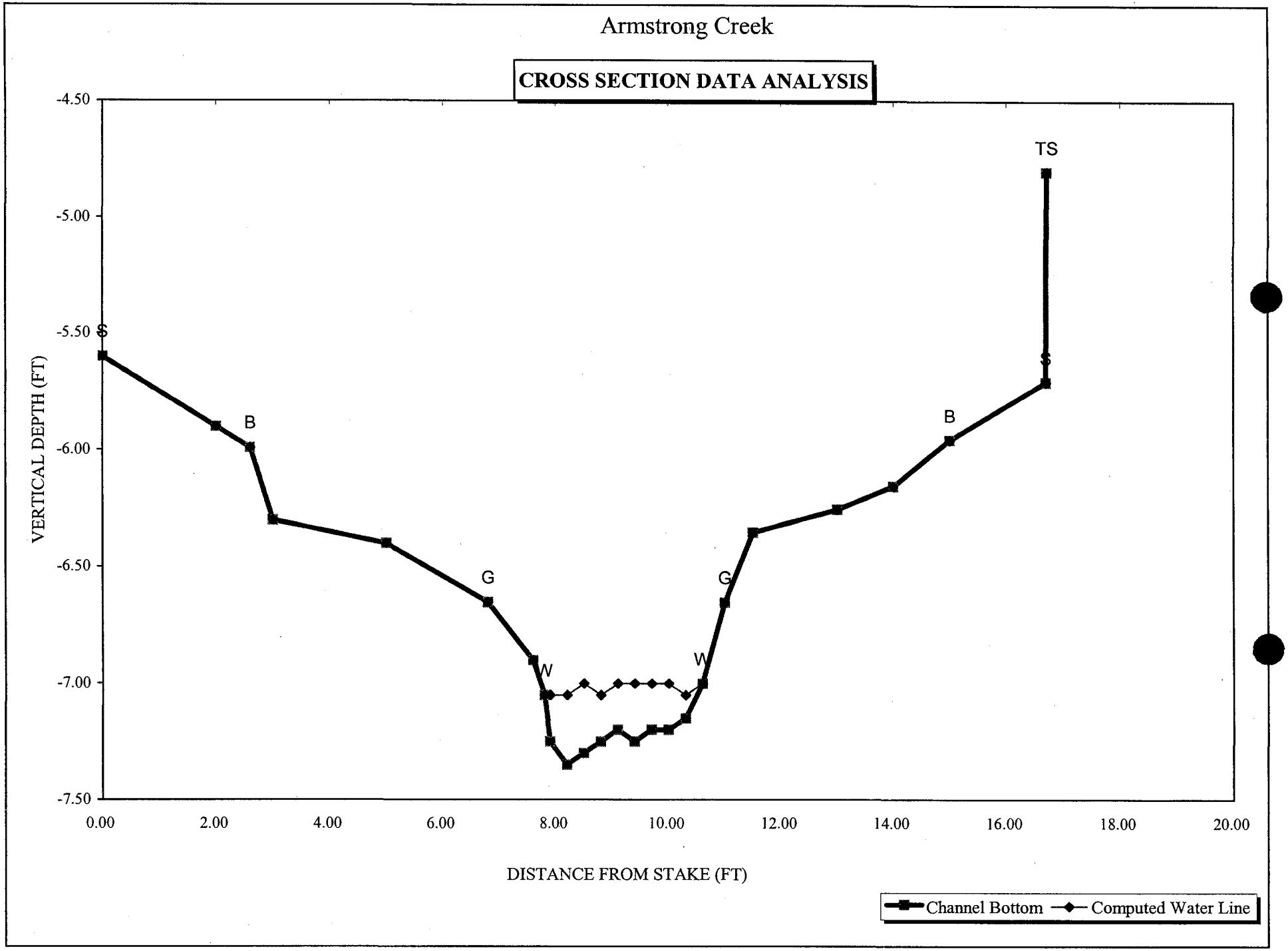
STAGING TABLE

GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

Velocity based on test of R/D84>1

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.65	4.20	0.44	0.70	1.84	4.62	100.0%	0.40	5.47	2.98
	6.67	4.11	0.43	0.68	1.75	4.52	97.8%	0.39	4.96	2.83
	6.72	3.89	0.40	0.63	1.55	4.27	92.5%	0.36	3.87	2.49
	6.77	3.67	0.37	0.58	1.36	4.03	87.3%	0.34	2.96	2.17
	6.82	3.46	0.34	0.53	1.18	3.79	82.0%	0.31	2.22	1.87
	6.87	3.24	0.31	0.48	1.02	3.54	76.7%	0.29	1.62	1.59
	6.92	3.06	0.28	0.43	0.86	3.34	72.2%	0.26	1.11	1.30
	6.97	2.94	0.24	0.38	0.71	3.18	68.8%	0.22	0.71 ←	1.00
WL	7.02	2.80	0.20	0.33	0.56	3.00	65.0%	0.19	0.42 →	0.74
	7.07	2.65	0.16	0.28	0.43	2.82	61.0%	0.15	0.23	0.53
	7.12	2.52	0.12	0.23	0.30	2.65	57.4%	0.11	0.10	0.34
	7.17	2.31	0.08	0.18	0.18	2.40	52.0%	0.07	0.04	0.21
	7.22	1.44	0.05	0.13	0.08	1.49	32.2%	0.05	0.01	0.12
	7.27	0.71	0.04	0.08	0.03	0.73	15.8%	0.04	0.00	0.06
	7.32	0.26	0.01	0.03	0.00	0.27	5.8%	0.01	0.00	0.01

Armstrong Creek



COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Armstrong Creek #1						CROSS-SECTION NO.: 07260502	
CROSS-SECTION LOCATION: 25 Yards d/s of Road Xing in California PARK							
Near Bench Mark Elevation 7912						40° 44' 34.8"	
DATE: 7/26/05	OBSERVERS: [illegible] / [illegible]					107° 08' 05.4"	
LEGAL DESCRIPTION	¼ SECTION: N E	SECTION: 15	TOWNSHIP: 9 (N/S)	RANGE: 87 E/(W)	PM: 6		
COUNTY: Routt	WATERSHED: Yampa	WATER DIVISION: 6	DOW WATER CODE:				
MAP(S): USGS: Quaker MT							
USFS:							

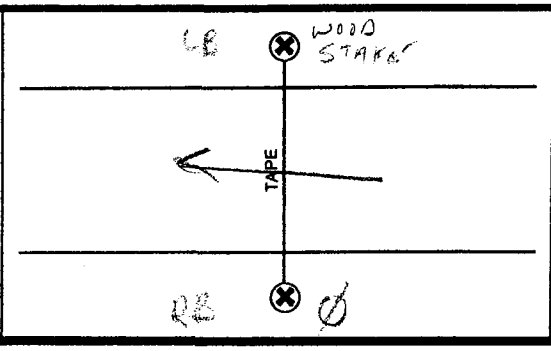
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES/NO)	METER TYPE: FLO-MATE			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: (YES/NO)	NUMBER OF PHOTOGRAPHS: 4 51, 52, 53, 54,		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(⊗) Tape @ Stake LB	0.0	4.80
(⊗) Tape @ Stake RB	0.0	5.60
(1) WS @ Tape LB/RB	0.0	7.00 / 7.05
(2) WS Upstream	63	5.60
(3) WS Downstream	32	7.90
SLOPE	2.3/95 = 0.0242	

SKETCH



LEGEND:
- Stake (⊗)
- Station (1)
- Photo (1)
- Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/(NO)	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

Several Fish Seen ≥ 50+ CRN 1-4"

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET OF
Armstrong Creek	07260502	7/26/05	1 OF 1

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)	Gage Reading: ____ft	TIME: 15:31

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Obser-vation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	0		5.60								
	2.0		5.90								
Rock	2.6		5.99								
	3.0		6.30								
	5.0		6.40								
G	6.8		6.65								
	7.6		6.90								
W	7.8		7.05	0				0			
	7.9		7.25	.20				.10			
	8.2		7.35	.30				.89			
	8.5		7.30	.30				.94			
	8.8		7.25	.20				.78			
	9.1		7.20	.20				1.21			
	9.4		7.25	.25				1.38			
	9.7		7.20	.20				0.30			
	10.0		7.20	.20				0.15			
	10.3		7.15	.10				0			
W	10.6		7.00	0				0			
G	11.0		6.65								
	11.5		6.35								
	13.0		6.25								
	14.0		6.15								
Bank	15.0		5.95								
S	16.7		5.70								
Top of bk	16.7		4.80								
TOTALS:											

End of Measurement	Time:	Gage Reading: ____ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

WATERC	WATERNAME	ATL	COC	SAMPDATE	SPEC	COMM
19035	ARMSTRONG CREEK	16	C1	6/28/2000	LGS	LONGNOSE SUCKER
19035	ARMSTRONG CREEK	16	C1	6/28/2000	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	6/28/2000	LND	LONGNOSE DACE
19035	ARMSTRONG CREEK	16	C1	6/28/2000	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/18/1998	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/18/1998	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/18/1998	BRK	BROOK TROUT
19035	ARMSTRONG CREEK	16	C1	8/18/1998	BRK	BROOK TROUT
19035	ARMSTRONG CREEK	16	C1	8/17/1998	BRK	BROOK TROUT
19035	ARMSTRONG CREEK	16	C1	8/17/1998	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	8/17/1998	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	8/17/1998	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	8/17/1998	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/17/1998	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/17/1998	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	7/25/1997	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	7/25/1997	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	7/25/1997	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	7/25/1997	WHS	WHITE SUCKER
19035	ARMSTRONG CREEK	16	C1	7/25/1997	WHS	WHITE SUCKER
19035	ARMSTRONG CREEK	16	C1	7/25/1997	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	7/25/1997	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	7/25/1997	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	7/25/1997	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	7/25/1997	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	7/8/1997	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	7/8/1997	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	7/8/1997	BRK	BROOK TROUT
19035	ARMSTRONG CREEK	16	C1	7/8/1997	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	7/8/1997	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	7/8/1997	WHS	WHITE SUCKER
19035	ARMSTRONG CREEK	16	C1	7/8/1997	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	7/8/1997	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	7/8/1997	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	7/8/1997	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	8/28/1996	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	9/24/1993	CRN	CO RIVER CUTTHROAT
19035	ARMSTRONG CREEK	16	C1	9/24/1993	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	9/24/1993	WHS	WHITE SUCKER
19035	ARMSTRONG CREEK	16	C1	9/24/1993	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	9/24/1993	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	8/28/1984	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	8/28/1984	MOS	MOUNTAIN SUCKER
19035	ARMSTRONG CREEK	16	C1	8/28/1984	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	8/14/1976	MTS	MOTTLED SCULPIN
19035	ARMSTRONG CREEK	16	C1	8/14/1976	MOS	MOUNTAIN SUCKER

WATERC	WATERNAME	ATL	COC	SAMPDATE	SPEC	COMM
19035	ARMSTRONG CREEK	16	C1	8/14/1976	SPD	SPECKLED DACE
19035	ARMSTRONG CREEK	16	C1	8/14/1976	BRK	BROOK TROUT
19035	ARMSTRONG CREEK	16	C1	8/14/1976	CRN	CO RIVER CUTTHROAT


ARMSTRONG
CREEK